ecology and environment, inc.
CLOVERLEAF BUILDING 3, 6405 METCALF, OVERLAND PARK, KANSAS 66202, TEL. 913/432-9961
International Specialists in the Environment

Site: LaClede Coal
ID #: MOD981715980
Break: 1.8
Other: 6-23-88

MEMORANDUM

TO: Paul Doherty, RPO

THRU: Sharon Martin, AFITOM

FROM: Eric Hess, E & E/FIT

DATE: June 23, 1988

SUBJECT: HRS Considerations and Recommendations for further work at the Mound St. Power site (aka LaClede Gas), St. Louis, Missouri
TDD #F-07-8708-29 PAN #FM00579PA
Site #Y33 Project #001
Superfund Contact: Pauletta R. France-Isetts

The results of the St. Louis Department of Health and the E & E/FIT sampling show that there is no PCB contamination of the oils in the basement of this former electric power plant facility. This conclusion is qualified by the fact that PCB detection limits were 1 ppm for the E & E/FIT data and that they are not known for the city of St. Louis data. Concentrations of PCB below the 1 ppm detection limit are possible in the samples collected by the FIT. However, no evidence was found to suggest that the oil in the basement may contain PCB. Initial concerns were based on the existence of large electric transformers on the site. Information obtained during the FIT investigation suggests that the oil in these transformers was moved off site. The most likely source of the oil is the Apex Oil Terminal located several yards uphill from the former electric power plant. This material is contained in a concrete basement and could easily be removed and sent to an oil recycling facility. Because this waste is contained, a removal operation could be undertaken readily and would be the most cost-effective approach for mitigating the oil contamination and circumventing further releases into the Mississippi River. The E & E/FIT does not recommend that a site investigation of the oil contamination be conducted.

The unexpected discovery of perhaps the largest coal gas plant site in Region VII, LaClede Gas and Light Company, mandates the E & E/FIT recommendation that a site investigation be conducted at this site. Currently, the Mound St. site is regarded as only the former plant facility. The clarification of site historical records suggests that the Mound St. site also should include the coal gasification works. Regardless of the final grouping of the power plant site and the gas works site, a site investigation should be conducted at the former LaClede Gas and Light Company.

The overall draft HRS score for this site was calculated to be 0.00, based solely on route characteristics. The low score reflects a lack of targets, documented contamination, and observed releases. The ground water route score is 0.0. If a release could be documented and some ground water use could be identified, this route score would increase to 6.12. The surface water route score is 0.0. If a release could be documented and industrial use of surface water confirmed, the route score would increase to 18.18. The nature of contaminants and the probable disposal methods used at this facility introduces the possibility for an air release of particulates. If this can be documented, the air route will score 55.64.

Assuming that observed releases and targets could be documented for the surface ground water, and air routes, the highest HRS score expected is approximately 34.75. This score is well above the score of 28.5 required for inclusion on the National Priorities List (NPL). However, if a lower socre is determined, it may not reflect the true potential hazard posed by this site: large amounts of waste may exist on site and they may be releasing PAHs, phenols, and cyanides into local ground and surface water. HRS-II guidelines, slated for implementation in October 1988, would add potential environmental and food chain scores. HRS-II would also allow scoring the risk posed by the migration of contaminated particulates. Addition of these elements could increase the HRS score. Currently, no score "threshold" has been established for HRS-II. Therefore, there is no method to predict the potential for this site to score high enough for inclusion on the NPL under the auspices of HRS-II rules.

Regardless of the current HRS score, or the potential HRS-II score, this site is likely to be having a deleterious effect on the local environment. The degree of this effect can only be assessed through soil sampling, ground water monitoring, and the installation of seepage meters to document ground water releases into the Mississippi River. It is recommended that this additional work be assigned a medium priority, based on the potential for direct contact/inhalation hazards and the potential for food chain contamination.

Preliminary Assessment
Mound Street Power Plant
St. Louis, Missouri
TDD #F-07-8708-29   PAN #FM00579PA
Site #Y33   Project #001
Prepared by: E & E/FIT for Region VII EPA
Task Leader: Eric Hess, E & E/FIT
Superfund Contact: Pauletta R. France-Isetts
Date: June 23, 1988

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SECTION 1: INTRODUCTION

The Ecology and Environment, Inc., Field Investigation Team (E & E/FIT) was tasked by the Region VII U.S. Environmental Protection Agency under Technical Directive Document (TDD) #F-07-8708-29, to conduct a Preliminary Assessment (PA) of the former Mound Street power plant, located in St. Louis, Missouri. This (PA) request was prompted by reports of oil accumulation in the facility and occasional oil releases to the Mississippi River. This preliminary assessment report will focus on potential chemical hazards associated with the current facility, and past operations on-site. E & E/FIT members Eric Hess and Kevin Hugill visited this site on September 17, 1987, to perform a site reconnaissance. In addition, oil samples were taken and analyzed for PCB contamination. EPA Preliminary Assessment Form 2070-12 is included as Appendix A.

SECTION 2: SITE DESCRIPTION AND HISTORY

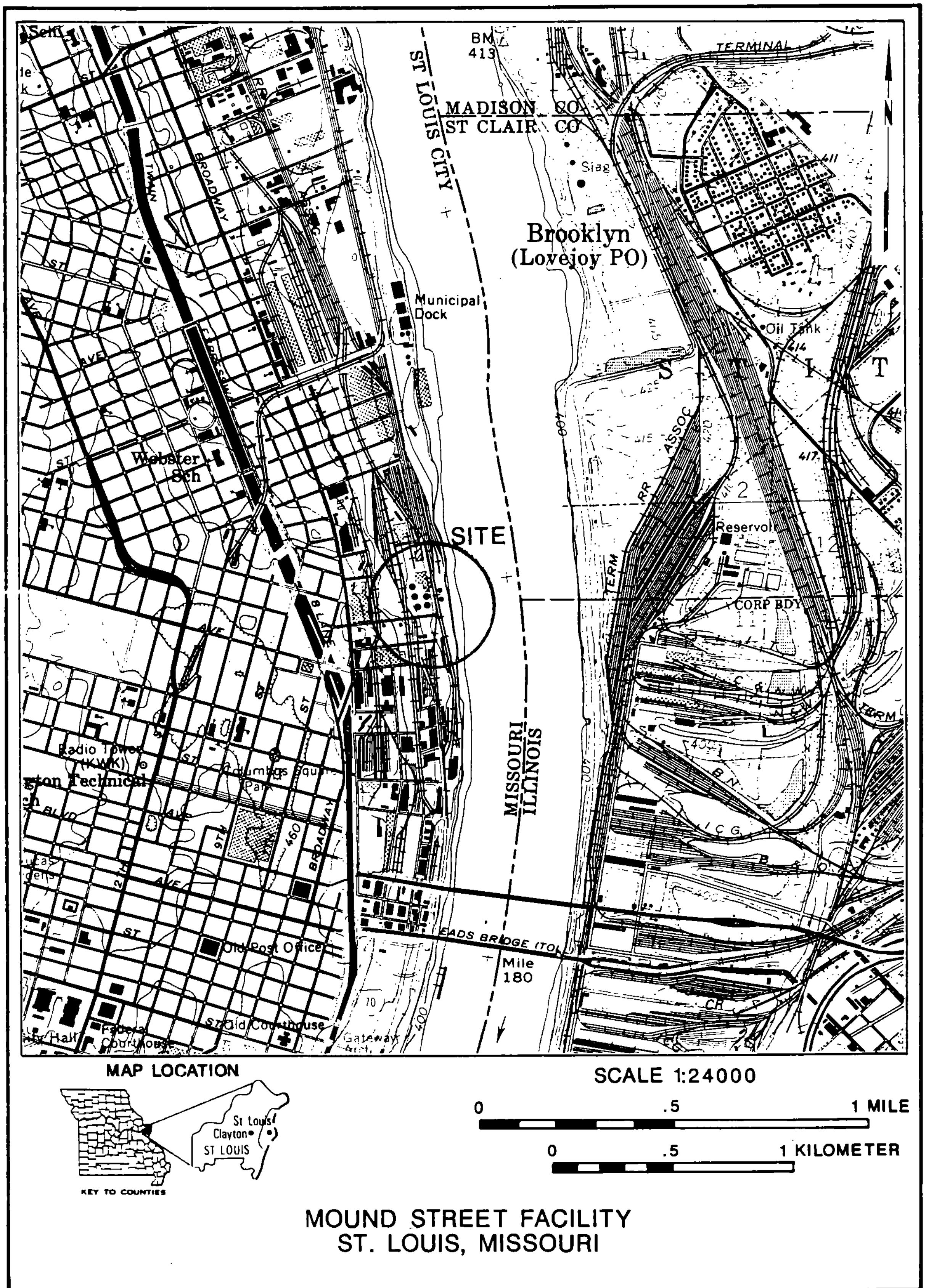
2.1 SITE DESCRIPTION

The Mound Street Power Plant is located in St. Louis, Missouri, approximately 1 mile north of the St. Louis Arch, along the Mississippi River (Ref. 1). The legal description of the power plant is city block 234-Tract #25, St. Louis Plan. The geographic coordinates of the site are 90° 11′ 00".0 east longitude, and 38° 38′ 30".00 north latitude (Figure 2-1). The facility is located in an industrial area adjacent to the river. Several large warehouses, a petroleum tank farm, and a large grain storage facility are all located within 1/4 mile of the facility. The tank farm is adjacent to the power plant, and the two facilities separated by several yards of paved road. Currently the site is occupied by the former Mound St. Power Plant building, and the Apex Oil Company St. Louis terminal (Figure 2-2). The site is not secured and access to the grounds buildings is relatively unrestricted. There are locks on most doors and a fence surrounds the petroleum storage tanks, no other security exists.

2.2 SITE HISTORY

The purpose of this section is to convey the close association between the current Mound Street Power Plant and the former coal gasification facility once located on this site. The two facilities should be considered one site.

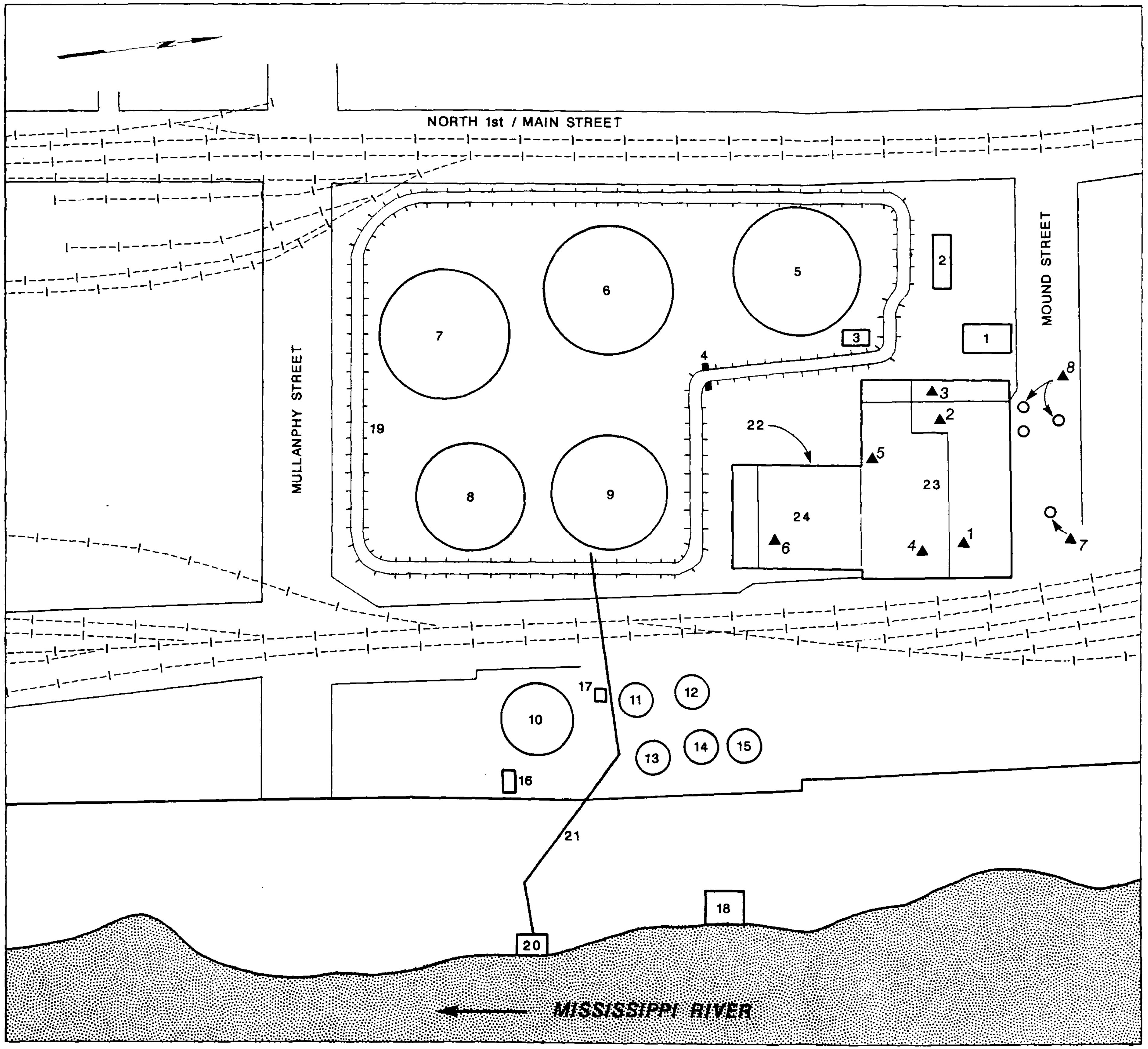
The earliest property records available indicate that this parcel of land was used by the Mound Street Warehouse Corporation until February 8, 1888 (Ref. 2). The Mound Street Warehouse Corporation sold the land and buildings to the Laclede Gas Light Company on February 8, 1888. The Laclede Company proceeded to construct a large coal gasification facility on the property. Figure 2-3 shows the Laclede Gas Facility at the turn of the century. Later, before 1904, the Laclede Company built an



WASTE SITE TRACKING NO.: MO0579
PREPARED BY: C. WILLIAMS

ECOLOGY & ENVIRONMENT FIT JAN. 1988
SOURCE: USGS 7.5' GRANITE CITY, IL. QUAD. 1982

FIGURE 2-1: SITE LOCATION



EXPLANATION

APEX OIL COMPANY
ST. LOUIS TERMINAL STRUCTURES

1. OFFICE
2. TANKER TRUCK LOADING PLATFORM
3. EQUIPMENT SHED
4. ENCLOSURE DRAIN PIPE
5. FUEL OIL TANK (80,000 Barrels)
6. FUEL OIL TANK (80,000 Barrels)
7. FUEL OIL TANK (80,000 Barrels)
8. FUEL OIL TANK (50,000 Barrels)
9. FUEL OIL TANK (55,000 Barrels)
10. OIL TANK
11. CRUDE OIL TANK
12. CRUDE OIL TANK
13. CRUDE OIL TANK
14. CRUDE OIL TANK
15. CRUDE OIL TANK
16. PUMP HOUSE
17. PUMP HOUSE
18. PUMP HOUSE (Abandoned)
19. CONTAINMENT BERM (For Fuel Oil Tanks, Capped With A Chain-link Fence)
20. PUMP HOUSE
21. RIVER TANKER OFF-LOADING PIPES

FORMER UNION ELECTRIC
MOUND ST. FACILITY
(Currently Owned By Mound St. Corp.)

22. FORMER UNION ELECTRIC BUILDING
23. GENERATOR ROOM (Basement Plan)
24. BOILER ROOM (Basement Plan)

○ STORM SEWER LID

▲2 SAMPLE LOCATION AND IDENTIFICATION

MOUND STREET FACILITY
ST. LOUIS, MISSOURI
(PRESENT DAY CONFIGURATION)

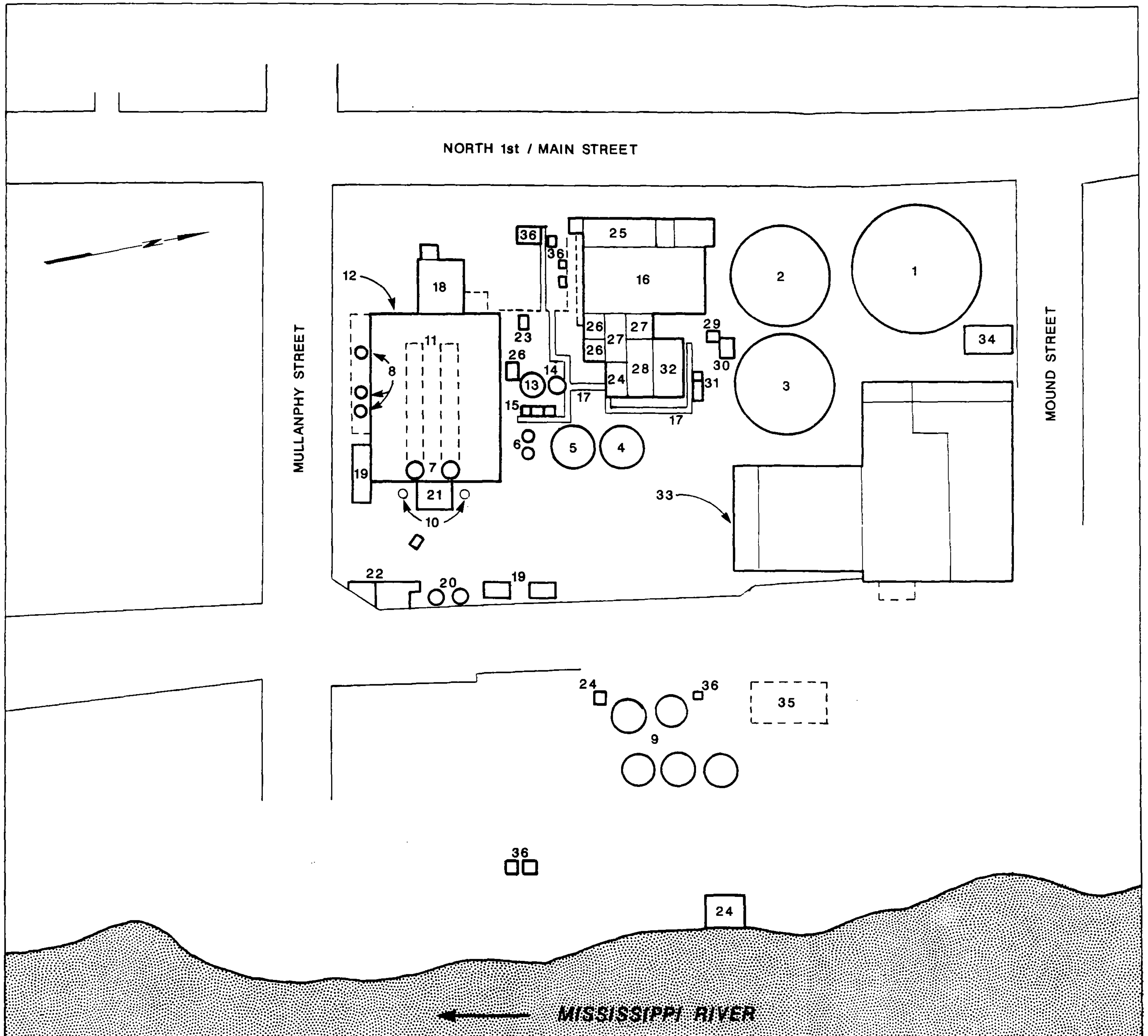
FIGURE 2-2

SCALE
0 200
FEET

ecology and environment, inc.
OVERLAND PARK, KANSAS

WASTE SITE TRACKING NO.: MO0579
PREPARED BY: C. WILLIAMS

FIT JAN. 1988



EXPLANATION

1. GAS HOLDER (787,927 Cubic Feet)
2. GAS HOLDER (656,431 Cubic Feet)
3. GAS HOLDER (337,368 Cubic Feet)
4. GAS PURIFIER (605 Cubic Yards)
5. GAS PURIFIER (605 Cubic Yards)
6. 2 - GAS SCRUBBERS (2,714 Cubic Feet Each)
7. 2 - TANKS, USE UNKNOWN (2,728 Cubic Feet Each)
8. 3 - TANKS, USE UNKNOWN (2,714 Cubic Feet Each)
9. 5 - FUEL OIL TANKS (130,725 Gallons Each)
10. 2 - RETORT SMOKE STACKS (90 Feet High And 8 Feet In Diameter Each)
11. 2 - BANKS OF RETORTS
12. RETORT HOUSE
13. AMMONIA WELL (56,111 Gallons)
14. AMMONIA WELL (22,628 Gallons)
15. TAR SEPARATOR (1,2244 Gallons)
16. PURIFIER HOUSE
17. PIPE TRENCHES (3 Feet Deep By 4 Feet Wide)
18. BLOWER HOUSE
19. GARAGE
20. TAR TANKS (53,844 Gallons Each)
21. STORAGE SHED
22. BLACKSMITH AND CARPENTER SHOP
23. STORAGE HOUSE
24. PUMP HOUSE
25. OFFICE AND METER ROOM
26. LABORATORY AND MACHINE SHOP
27. SCRUBBER HOUSE
28. CONDENSER HOUSE
29. GOVERNOR HOUSE
30. VALVE HOUSE
31. METER AND SWITCH HOUSE
32. EXHAUSTERS AND BLOWERS
33. LACLEDE ELECTRIC POWER FACILITY
34. OFFICE
35. TRANSFORMERS
36. UNKNOWN

MOUND STREET FACILITY
(LACLEDE GAS AND LIGHT CO.)
ST. LOUIS, MISSOURI
CIRCA 1900

FIGURE 2-3

SCALE
0 200
FEET

ecology and environment, inc.
OVERLAND PARK, KANSAS

WASTE SITE TRACKING NO.: MO0579
PREPARED BY: C. WILLIAMS

FIT JAN. 1988

electric power plant on the facility. This facility provided all the electric and gas power for the 1904 St. Louis Worlds Fair. On March 23, 1940, the name of the facility was changed to the Laclede Power and Light Corporation (aka Laclede Electric), and the Laclede Gas Light Company (aka Laclede Gas). This suggest that the operations were separated, at least financially. At some time between 1940 and 1945 a company called Phoenix Light, Heat and Power was involved in the Laclede operations. The exact nature of their involvement was not uncovered during the present document search. On March 23, 1945, the entire facility was sold to Union Electric Company. According to Union Electric representatives, Union Electric Company never manufactured gas at this site (Ref. 3). This indicates that 1945 is the approximate closure date of the coal gasification works. Union Electric continued to use the electric power facility until 1973. In 1969 Union Electric sold the former coal gas works to the Apex Oil Company. Between 1969 and 1972 Apex Oil dismantled the old coal gas plant and constructed a petroleum tank farm on the site. This Apex facility stored various petroleum fuels until the mid 1980s when it became one of two Apex Oil asphalt product terminals in St. Louis. Currently the terminal stores and distributes asphalt and #6 fuel oil.

On August 15, 1973, Union Electric sold the electric power plant with, all its machinery intact and operational to the Tenlis Company. The Tenlis Company dismantled the power generation and transmission equipment, including boilers, generators, and transformers. The transformer oil was allegedly removed by Midwest Oil Company, of St. Louis, Missouri (Ref. 3). The equipment was sold as scrap metal. On August 17, 1981, the Tenlis Company sold the former electric works to Azcon Corporation. The Azcon Corporation may be connected with metal recycling. On October 22, 1985, Azon Corporation sold the former electric works to the Mound Street Corporation, the present site owner. Currently the building is leased by Jim McNabb, who uses the buildings to house his electric motor stripping operation.

2.3 LACLEDE COAL GASIFICATION OPERATIONS

The Laclede coal gas facility operated for almost 60 years. An estimated production schedule for this facility is listed in Table 2-1. It should be noted that this facility was over 10 times larger, in terms of production, than the Key City facility in Dubuque, Iowa. Therefore, the Laclede facility may be the **largest** coal gasification plant in Region VII

Table 2-1
Estimated Production Record for the
Laclede Coal Gas Plant
St. Louis, Missouri

		Gas Production Rate ($ft.^3/yr.$)					By-Products (10^3 gallons)		
Year	Gas Type	Coal	Water	Coke	**Total**	Coke	Tar	Ammonia	Other
1890	Coal	1,000			1,000				
1900	Coal	1,200			1,200				
1910	Coal, Water	1,200	2,800		4,000				
1920									
1930	Coal, Water, Coke	1,692	2,323	2,022	6,037	337	4,355	2,789	821,17* lbs sulfate
1940	Coke			1,969	1,969				
1950	Coke			1,338	1,338				
AVERAGES:		**1,273**	**2,562**	**1,776**	**2,591**	**337**	**4,355**	**2,789**	

(Ref. 4)
* Sold to the U.S. Army for munition manufacture.

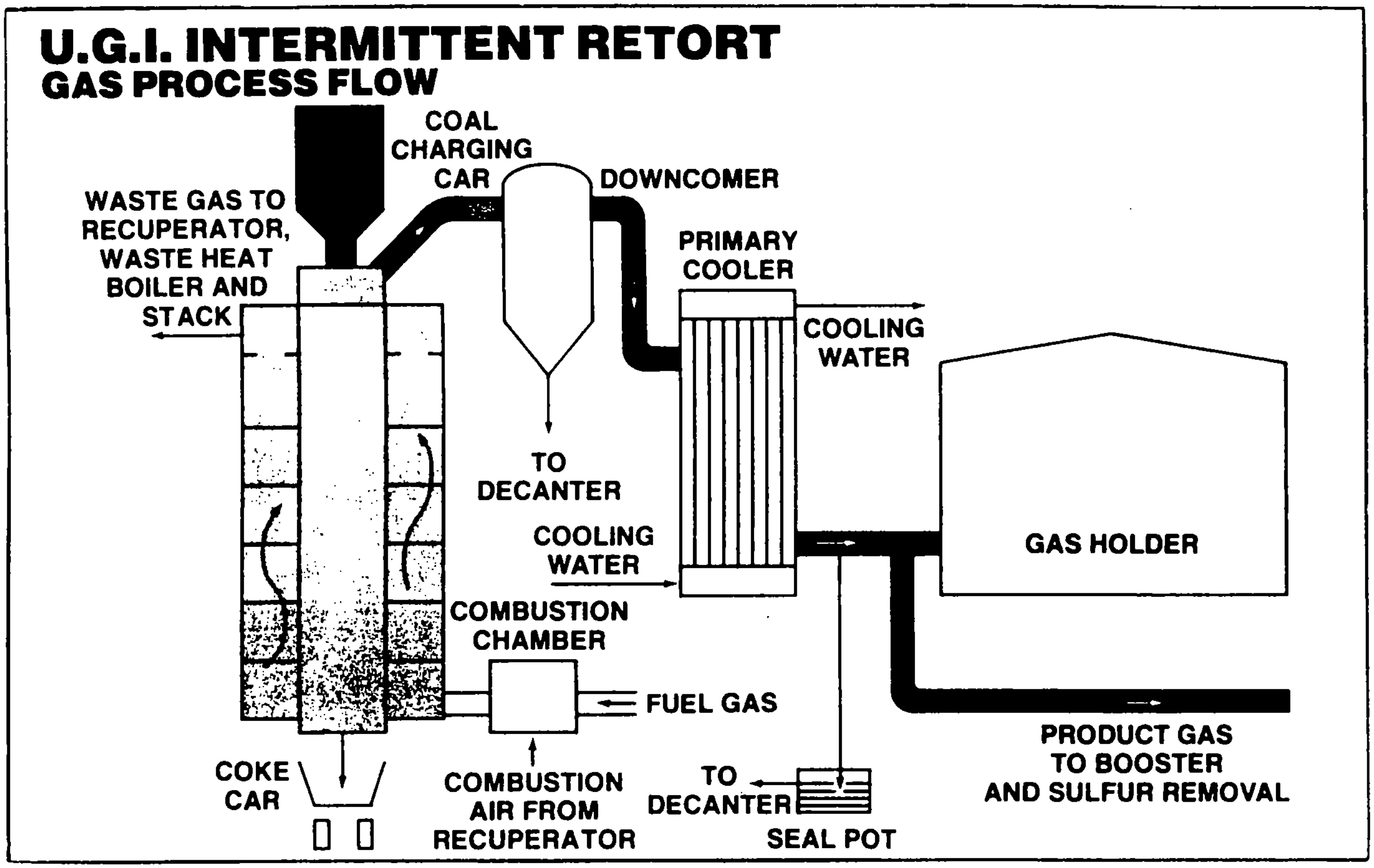
In the 19th century and the first half on the 20th century, natural gas substitutes were manufactured from coal and petroleum oils. These products were distributed for a variety of residential, commercial, and industrial uses. The diverse uses of manufactured gas included the operation of home appliances, lighting, furnaces, and internal combustion engines.

Because distribution technologies of the era were limited, manufactured gas plants were situated near areas of high demand, usually major metropolitan centers. In the late 1950s, these facilities were phased-out as petroleum and natural gas pipeline distribution facilities became widely established. Natural gas is a more convenient and economical form of energy. Many manufactured gas facilities were sold or destroyed to make way for new construction. Generally, the waste containers were left underground and in some cases were covered by new construction. Approximately 1,500 manufactured gas sites have been identified in the United States. EPA Region VII has approximately 142 coal gasification sites (Ref. 4).

The major gas manufacturing process used was the UGI intermittent retort process (Ref. 5). This method produced gas through coal carbonization (Figure 2-4). During this process, coal is heated in the retort and the resulting coal gas is removed through its top. The gas is run through a condenser and a scrubber before it is moved into the gas holder. Wastes are produced in the condenser and scrubber and in the retort itself. The coal is carbonized in batches and the resulting coke is discharged after each period of carbonization. In the latter stage of a carbonization period, steam can be introduced into the fuel bed. This displaces residual coal gas and reacts with the hot coke to produce water gas. The resulting increase in gas production is substantial. The majority of manufactured gas in the United States was produced by this process.

This manufactured gas is often called city gas, coal gas, or town gas. It is relatively rich in hydrogen, methane, and carbon monoxide, and exhibits a heating value of about 500 British thermal units/per cubic foot (Btu/cf) (Ref. 5). The coke produced by this process is highly reactive and an excellent smokeless fuel for domestic heating.

A second type of retort process is the continuous retort. It features a continuous fuel feed system and a continuous discharge of coke. An analysis of typical retort gas is listed in Table 2-2.



Reference 5

THIS MANUFACTURED GAS MACHINE WAS THE MOST COMMON TYPE IN USE DURING THE PEROID OF OPERATION FOR THE LACLEDE FACILITY.

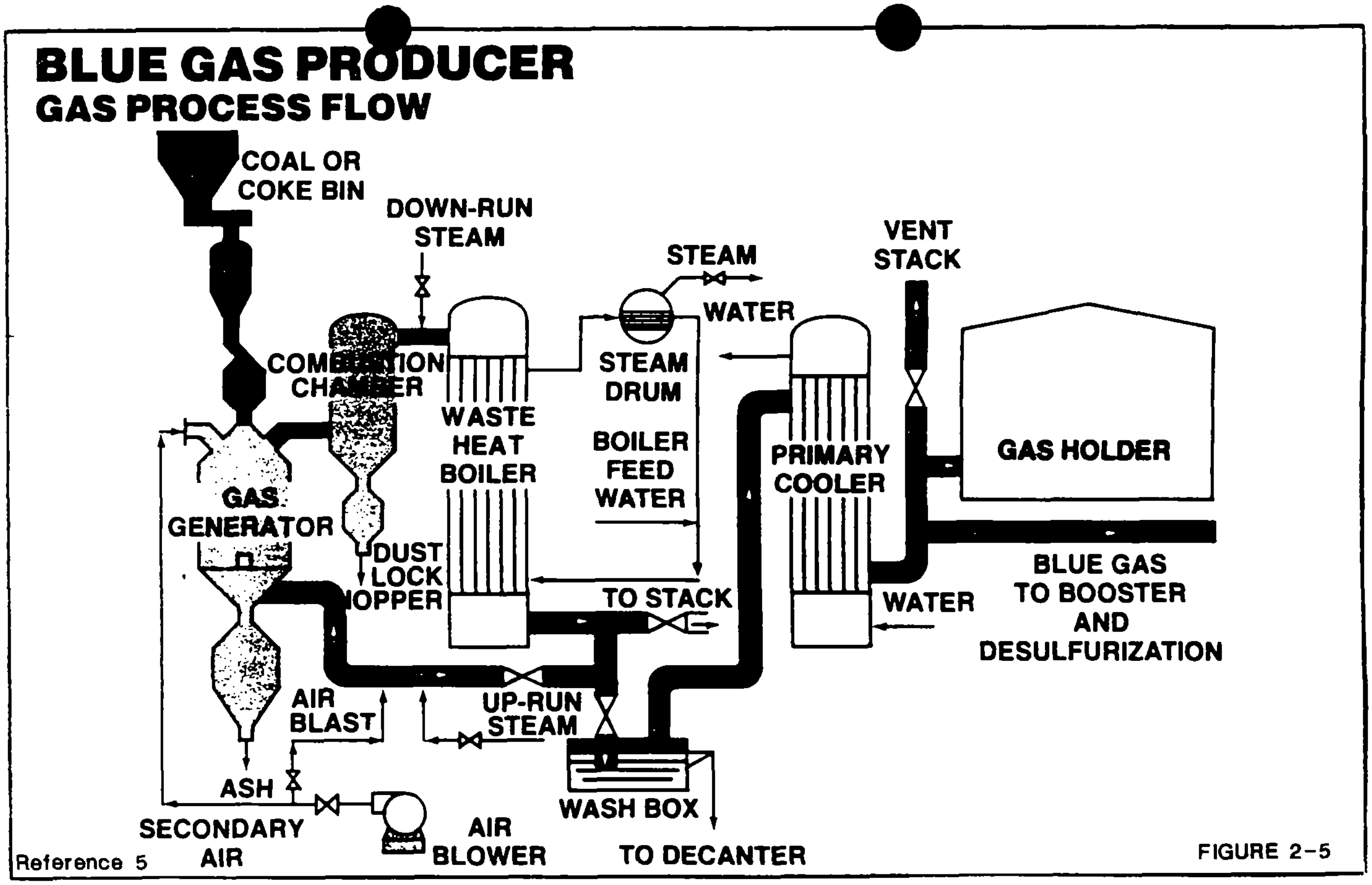
FIGURE 2-4

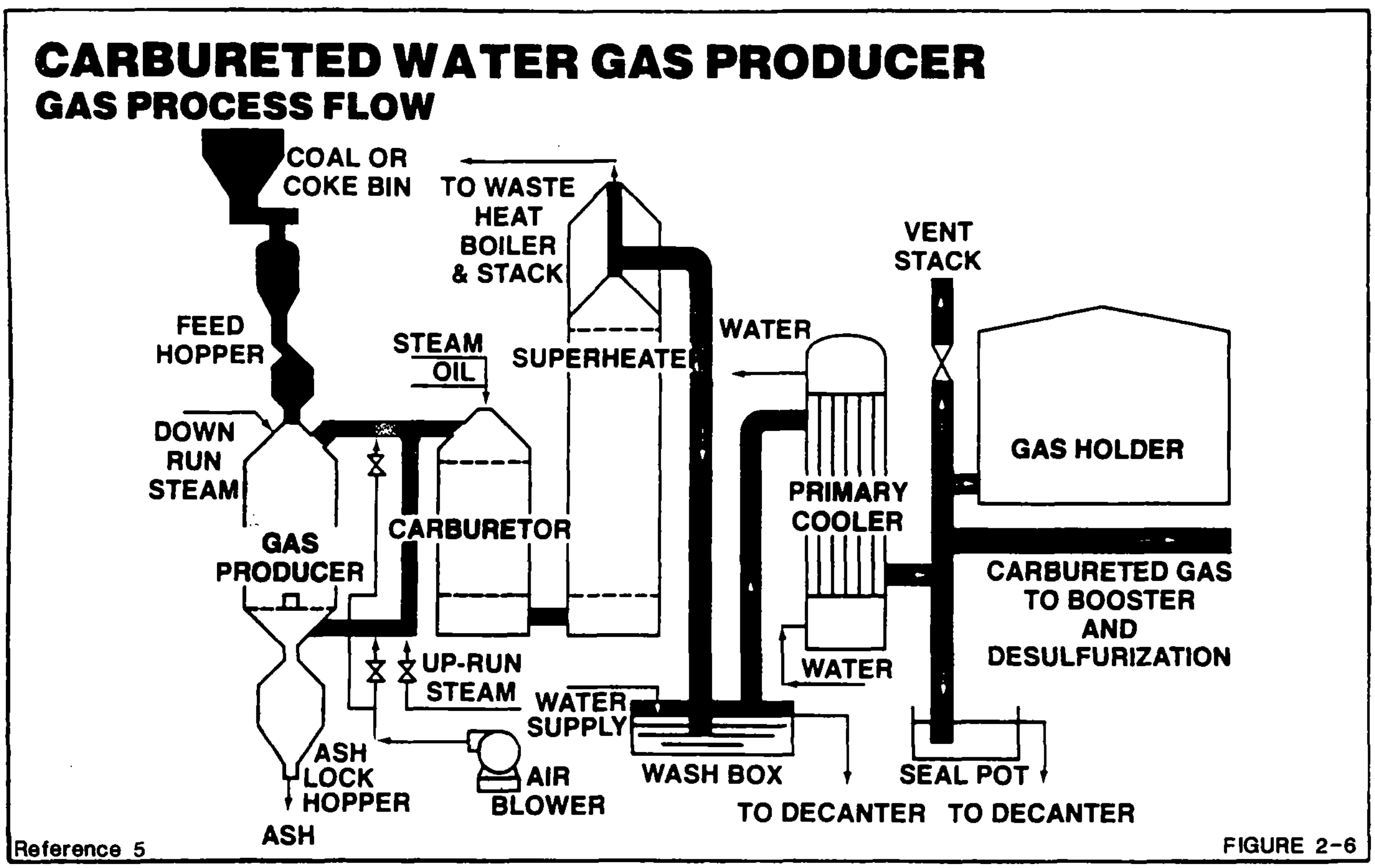
Table 2-2
Chemical Composition of Typical Retort Gas

	Volume Percent in Various Gases	
	Intermittent	Continuous
Carbon Dioxide	2.1	3.0
Illuminants	3.4	2.8
Oxygen	0.4	0.2
Carbon Monoxide	13.5	10.9
Hydrogen	51.9	54.5
Methane	24.3	24.2
Nitrogen	4.4	4.4
Btu/cf	520.0	532.0
Specific Gravity	0.42	0.42

Source: Ref. 5

Another type of manufactured gas is known as blue gas or water gas. This gas is rich in hydrogen and carbon monoxide and exhibits a heating value of approximately 300 Btu/cf (Ref. 5). This product is produced by passing steam over incandescent coal or coke in a gas generator (Figure 2-5). The resulting chemical reaction is endothermic and thus is maintained by periodically forcing air into the coal or coke beds, allowing it to combust at a controlled temperature. To avoid contaminating the blue gas with excessive nitrogen or carbon dioxide, the steam and combustion phases are cycled. A chemical analysis of a typical blue gas is listed in Table 2-3.





OTHER MANUFACTURED GAS MACHINES COMMONLY USED DURING THE MANUFACTURED GAS ERA, 1890-1950.

Table 2-3
Chemical Composition of a Typical Blue Gas

	Volume Percent of Various Gases
Carbon Dioxide	5.5
Carbon Monoxide	37.3
Hydrogen	47.6
Methane	1.2
Nitrogen	8.4
Btu/cf	287
Specific Gravity	0.57

Source: Ref. 5

Blue gas may be enriched by cracking petroleum oil in the presence of blue gas and steam. This forms carbureted water gas (Figure 2-6). Through the proper manipulation of the oil injection, it is possible to produce a carbureted water gas with a heating value of over 1,000 Btu/cf. Analyses of typical carbureted water gases of varying heating values can be seen in Table 2-4.

Table 2-4
Chemical Composition of Typical Carbureted Water Gas

	Volume Percent of Various Gases			
Carbon Dioxide	3.4	4.3	1.6	4.4
Illuminants	8.4	12.6	18.9	27.4
Oxygen	1.2	0.7	0.2	1.1
Carbon Monoxide	30.0	30.2	21.3	9.1
Hydrogen	31.7	29.3	28.0	19.9
Methane	12.2	17.8	20.7	21.8
Ethane	0.0	0.0	4.3	5.3
Propane	0.0	0.0	0.0	0.3
Nitrogen	13.1	5.1	5.0	10.7
Btu/cf	540	695	850	1010

Source: Ref. 5

The manufacturing capacity of a gasification plant is determined by the size of the gas generator or retort, the type and size of fuel used, and the rate of air and steam injection. A standard gas generator, with a 9-foot inside diameter, can produce about 6 million cubic feet (ft^3) of blue gas per day. This is equivalent to almost 4,000 ft^3 of blue gas per square foot of gas generator per hour (Ref. 5). A retort can produce up to 15,000 ft^3 of gas per ton of coal (Ref. 6).

A conventional carbureted water gas apparatus consists of four shells: the gas generator, carburetor, superheater, and purifier (wash box) (Figure 2-6). The gas generator produces the blue gas. The blue gas is passed into a carburetor where petroleum oil is sprayed into it, producing an oil gas. This mixture is passed through the superheater where the oil vapors are converted into more simple gases. These gases are directed to a wash box for cooling, where the tars (coal tars) condense in the wash box. Unwanted constituents such as hydrogen sulfide (H_2S) also are removed at this stage. As the carburetion process is expanded, increasing the Btu/cf of the product, the production capacity of the plant is reduced.

The disposition of the by-products of the major gasification processes is presented in Table 2-5.

Table 2-5
Common By-Product Disposition
for the Average Coal Gasification Facility

By-Product	Percent of Total Produced* Sold	Unaccounted for
Tar	76	24
Coke	62	38
Ammonia	N.D.	N.D.
Naphthalene, Crude	46	54
Crude Light Oil	26	74
Light Oil Derivatives	55	46
Screenings and Breeze	13	87
Spent Iron Oxide	N.D.	N.D.
Spent Lime	N.D.	N.D.

* = Based on averages from 1925, 1927, 1929, and 1931.
N.D. = No Data.
(Ref. 4)

2.4 PAST INVESTIGATIVE ACTIVITIES

Cynthia Dillion, Marine Safety Officer-United States Coast Guard, traced the initial Coast Guard involvement with this site to 1975 (Ref. 7). Since 1976 the Coast Guard has been requested to investigate three separate oil slicks on the Mississippi River, possibly originating from the former electric power facility. Although records are not complete, it appears that the oil problem in the basement of the former electric power plant was a suspected source of these oil spills. Dillion claims that the Region VII EPA was notified of this problem in 1975. The Coast Guard never sampled the oil.

On April 8, 1987, the St. Louis Division of Health sampled the oil in the basement of the former electric power plant. Daniel Wilson, Environmental Sanitation Specialist, conducted the sampling effort. Six samples were collected and analyzed for PCB. None of the samples showed PCB contamination, although no listing of the detection limits were included on the data transmittal.

On September 17, 1987, the E & E/FIT conducted a site reconnaissance of the former electric power plant. The E & E/FIT took six liquid samples from the basement of the facility and two samples from two different manholes adjacent to the facility (Figure 2-2). All samples were screened for PCBs at a 1 ppm detection limit. No PCB contaminants were identified by the Tracor gas chromatograph. Sample #1 was taken from a pool of oil/water 6 inches to 2 feet deep. Sample #2 was taken from a pool of apparently pure oil, over 6 feet deep. Sample #3 was taken from another pool of apparently pure oil, over 6 feet deep. Sample #4 was taken from a bucket of thick oil/sludge. Sample #5 was taken from a pool of oil/water over 6 feet deep. Sample #6 was taken from a pool of clear water over 8 feet deep. Samples #7 and #8 were taken from manholes containing oil/water mixtures. All samples were collected with 1/2 inch thieving rods. Samples taken from basement locations were collected in level B personal protection while conducting initial on-site monitoring. No HNu readings above background were recorded. Oxygen levels in the basement averaged 19.8%. The MSA combination O_2/explosimeter did not indicate an explosive atmosphere.

2.5 ATTRIBUTION OF OIL CONTAMINATION IN BASEMENT

Jim McNabb, manager of operations in the power plant claims that the Apex Oil terminal has had numerous oil spills, some of which have lead to the flooding of the power plant basement (Ref. 3). McNabb claims the largest spill occurred in 1981 when a flow, several feet deep, was released down Mound Street. McNabb indicated that the large transformers associated with the power plant were drained by the Tenlis Company, and removed by the Midwest Oil Company. Midwest Oil Company could not confirm or deny this fact, due to the lack of records from the early 1970s.

Tom Kniestedt, Apex Oil Company, denied that the terminal has had any major spills (Ref. 3). Rather, he indicated that the loading platform on the river has been the source of several spills. This may explain the three spills noted by the Coast Guard. Kniestedt said that the Tenlis Company drained the transformers and hydraulic oil tanks into the basement.

Herman Gellman, current president of the Mound Street Corporation, supported McNabb's statements. Gellman, as McNabb, has been associated with this site for the past fifteen years.

Based on the interviews and the sample analysis, the most likely source of the oil in the power plant basement is from spills at the Apex Oil Terminal.

2.6 SITE CONTACTS

Daniel Wilson
Environmental Sanitation Specialist
St. Louis Division of Health
P.O. Box 14702
St. Louis, Missouri 63178
(314) 658-1000

Jim McNabb
Fairview Heights, Illinois
(618) 397-5125 (Home)
(314) 231-7377 (Work)

Richard Hargraves
Public Relations and Advertising
Laclede Gas Company
720 Olive Street
St. Louis Missouri 63101
(314) 342-0654

Cynthia Dillion
Marine Safety Officer
U.S. Coast Guard
210 North Tucker Blvd.
St. Louis, Missouri 63101
(314) 425-5823)

John Pozzo, Jr.
Environmental Services Department
Union Electric Corporation
1901 Gratiot Street
St. Louis, Missouri 63166
(314) 554-2280

Herman Gellman
President, Mound Street Corporation
3620 North Hall Street
St. Louis, Missouri 63147
(314) 231-6077

Tom Kniestedt
Apex Oil Company
St. Louis, Missouri
(314) 889-9600

Glenn Gettinger
Midwest Oil Company
1900 Walton Road
St. Louis, Missouri
(314) 427-2662
(314) 731-3561

SECTION 3: WASTE CHARACTERISTICS

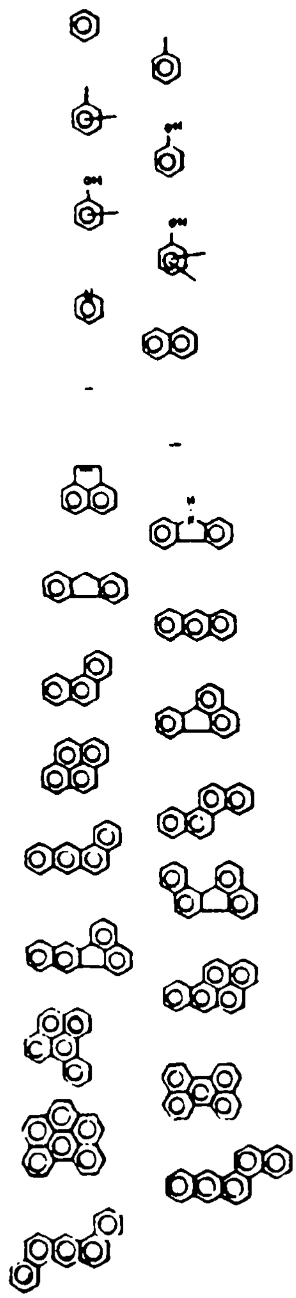
3.1 GENERAL WASTE STREAMS FOR COAL GAS SITES

The two waste products of primary concern are tar sludges (coal tars) and spent oxides. Ammonia wastes are also by-products of this production process, but are not considered hazardous. Coal tar wastes are primarily polynuclear aromatic hydrocarbons (PAHs) and phenolics produced during coal or coke combustion and during the oil injection process (Figure 3-1). Spent iron oxide wastes are produced during the gas purification process where impurities are removed from the manufactured gas. Iron oxide wastes contain sulfur compounds, cyanide compounds, and small quantities of coal tar. Light aromatics such as benzene, toluene, and xylene (volatile organic compounds) also are occasional constituents of coal tar wastes (Figure 3-1). For this study, volatile organics analysis was not requested.

Coal tars are removed from the gas in the wash box and condenser. These tars are also present in the oxide wastes. These wastes could either be sold or disposed of in pits or holding tanks. Coal tar can also be used as wood preservatives, road treatments, herbicides, or sold to coal tar refineries for further processing.

Some of the PAH compounds likely to be present in the tar wastes are carcinogenic and are listed as RCRA Part 261 hazardous wastes. All PAHs can be considered as carcinogenic as benzo(a)pyrene, a Class A carcinogen (Ref. 8). The carcinogenic potential of PAHs can be assessed through a determination of total PAH concentrations (summation of the concentrations of all PAHs detected in a given sample). Drinking water standards for PAHs are incomplete.

Iron oxide wastes are produced when manufactured gas is passed through a bed of active hydrated iron oxide. The active hydrated iron oxide is usually carried on small wood chips or corncobs. This process

	Component	Formula	Structure	Boiling Point, °C
	Benzene	C_6H_6		80
	Toluene	C_7H_8		111
	Xylenes	C_8H_{10}		138-144
	Phenol	C_6H_5OH		181
	Cresols	C_7H_7OH		191-202
	Xylenols	C_8H_9OH		201-227
	Pyridine	C_5H_5N		115
PAH COMPOUNDS	Naphthalene	$C_{10}H_8$		218
	Methylnaphthalenes	$C_{11}H_{10}$	-	241-245
	Dimethylnaphthalenes	$C_{12}H_{12}$	-	262-269
	Acenaphthene	$C_{12}H_{10}$		277
	Carbazole	$C_{12}H_9N$		355
	Fluorene	$C_{13}H_{10}$		297
	Anthracene	$C_{14}H_{10}$		340
	Phenanthrene	$C_{14}H_{10}$		340
	Fluoranthene	$C_{16}H_{10}$		393
	Pyrene	$C_{16}H_{10}$		394
	Chrysene	$C_{18}H_{12}$		436
	Benz(a)anthracene	$C_{18}H_{12}$		438
	Benzo(j)fluoranthene	$C_{20}H_{12}$		~480
	Benzo(k)fluoranthene	$C_{20}H_{12}$		480
	Benzo(a)pyrene	$C_{20}H_{12}$		496
	Benzo(e)pyrene	$C_{20}H_{12}$		493
	Perylene	$C_{20}H_{12}$		460
	Benzo(g,h,i)perylene	$C_{22}H_{12}$		500
	Benzo(b)chrysene	$C_{22}H_{14}$		~500
	Dibenz(a,h)anthracene	$C_{22}H_{14}$		-

Reference 5

Chemical Compounds Associated with Coal Gasification

FIGURE 3-1

filters impurities from the raw manufactured gas. The spend oxide can be regenerated by contact with ambient air. It can be reused until tar accumulation and reaction with cyanide, which produces ferrocyanides, causes it to lose activity. The spend oxide waste is usually blue-gray in color, due to the presence of ferrocyanide salts (Ref. 5). Table 3-1 gives an analysis of typical spent iron oxide waste.

Table 3-1

An Analysis of Typical Spent Oxides

	Percent
Free Sulfur	44.70
Moisture	17.88
Ferric monohydrate	5.26
Ferrous monohydrate	6.25
Basic ferric sulfate	1.25
Ferric ammonium ferrocyanide	3.80
Ferrosoferric ammonium ferrocyanide	2.50
Ferric pyridic ferocyanide	1.20
Organic matter peat fiber	4.68
Tar	1.21
Silica	1.05
Naphthalene	0.72
Pyridine sulfate	0.77
Ammonium sulfate	2.06
Calcium sulfate	0.12
Ferrous sulfate	0.02
Ammonium thiocyanate	1.30
Sulfur otherwise combined	1.33
Organic matter soluble in alkalies (humus)	1.54
Combined water and loss (by difference)	2.36
TOTAL	100.00

Source: Ref. 5

3.2 ENVIRONMENTAL FATE OF COAL GASIFICATION WASTES

PAH and phenolic compounds may enter the atmosphere through volatilization. Once in this matrix, the materials may undergo molecular or advective diffusion. (All further references to dispersion characteristics will infer both molecular and advective processes). PAH compounds are likely to undergo dispersion when introduced into surface water. If this occurs, the contaminants are very susceptible to adsorption onto clay particles suspended in the water. Depending on the nature of the surface water, this material may also volatilize; thus entering the atmosphere. Once in the surface water the PAH compounds are prone to chemical alteration through biodegradation or photolysis. Phenolic compounds are likely to undergo dispersion in surface water. They are not readily absorbed to clay particles. These compounds may also undergo volatilization and limited biodegradation in surface water.

PAHs in ground water are also likely to undergo dispersion and adsorption processes. Biodergradation of these materials is unlikely, however, in this matrix (Ref. 5). Phenolic compounds in ground water can be transported through dispersion. It is possible that these chemicals may undergo limited biodegradation in ground water environments (Ref. 5).

In the soil matrix, PAHs can be involved in adsorption processes as well as biodegradation reactions. These materials may also undergo volatilization, leaching, and photolysis depending on site-specific characteristics. Phenolic compounds in the soil environment can be leached readily or removed through biodegradation (Ref. 5).

PAH compounds are stable and tend to be retained in sediments. The specific stability of a particular PAH compound is dependent on its chemical structure (Ref. 8 and 5). Generally the stability/solubility is inversely related to the molecular weight of the PAH (Figure 3-1). The arrangement of rings is also important. For example, anthracene is relatively soluble. It is a medium mass PAH composed of three linear rings. The arrangement of the rings allow this relatively massive molecule to be soluble. Benzo(a)pyrene is composed of a single ring surrounded by rings on three sides of its six sides. It is one of the more massive PAHs.

This material is more stable than anthracene, the most soluble PAH. When the rings become arranged in a step-wise fashion, they are members of the most stable PAH group. An example of this is chrysene. The basic structures of the major PAHs are found in Figure 3-1.

PAH compounds are produced by both natural and man-made processes, including most combustion events. Coal tar products are composed primarily of PAH and phenolics; petroleum products may contain trace amounts of these materials. Removal of PAH materials through volatilization is not believed to be significant. Adsorption of PAHs onto soil particles is an important barrier to transport. This process depends on the physical/chemical properties of both soil and the transported material: characteristics of the chemical itself, soil moisture, temperature, availability of exchange sites on the soil particles, and pH. All PAH compounds except napthalene are strongly adsorbed onto soil particles. PAHs may undergo microbial degradation, particularly the more water soluble and lighter compounds. For example, napthalene is readily oxidized by Pseudomonas (Ref. 5).

Phenolic compounds are generally highly water soluble (in excess of 10,000 mg/l) and have low vapor pressures (Ref. 5). The low vapor pressure reduces the tendency for this material to volatilize. Phenolics are produced through both man-made and natural processes, including coal tar production, oil and chemical refinery processes, gray iron foundry operations, human/livestock wastes, and the decay of organic matter. Typical soil background levels of phenolics can range from 0.10 to 0.50 mg/l (Ref. 5). Phenolics are not absorbed by mineral particles, and their affinity for adsorption onto organic matter is limited. The adsorption of these constituents in the soil matrix is directly proportional to the abundance of organic matter in the soil. Biodegradation of phenolics is common, although high concentrations may temporarily repress the process. An example of a bacteria that can metabolize phenolics is Pseudomonas putida (Ref. 5).

Two types of cyanide may be present at a coal gasification site: simple and complex cyanides. Simple cyanides are formed when cyanide reacts with an alkali or metal, producing a soluble material that can liberate a CN^- anion in water. Simple cyanides can be decomposed by bacteria in the soil (Ref. 5). Complex cyanides are alkali-metal cyanides that are relatively insoluble (Ref. 5). Complex cyanides, particularly the ferrocyanide compounds, are more resistant to biodegradation. These materials are associated with oxide wastes.

The trace metals most likely to be found on a coal gasification site are: arsenic, chromium, copper, iron, lead, nickel, and zinc (Ref. 5). All are readily adsorbed onto soil particles. The mobility of these constituents is controlled by the pH of the soil. As a general rule, the solubility of these metals increases as pH decreases. Low pH values also reduce the cation exchange capacity of the soil matrix due to the preferential adsorption of H^+ ions. Cation exchange is generally considered the major barrier to metals transport in soils. The strong tendency of metals to be bound to soil particles and organic matter limits their impact on ground water resources.

The migration of coal tar in ground water has been observed in several former coal gas manufacturing sites (Ref. 5 and 9). Coal tar is more dense than water and tends to migrate downward through porous material to a confining layer of less porous material. In areas where this behavior is exhibited, the following stratification (from top to bottom) may be expected: ground water with dissolved organics; ground water with trapped coal tar; and, below the confining layer, ground water with dissolved organics (Ref. 5).

3.3 GENERAL WASTE STREAMS ASSOCIATED WITH ELECTRIC POWER GENERATION AND FUEL STORAGE

Waste products of primary concern are polychlorinated biphenyls (PCB). Commerical petroleum products such as diesel and heating oil are not considered hazardous under RCRA, 40 CFR 261.

A PCB is any one of 209 compounds with the general chemical formula $C_{12}H_xCl_x$. PCB are produced by chlorinating available biphenyl compounds and the different structural arrangements make possible 209 compounds distributed among the 10 levels of chlorination (Table 3-2, Ref. 10). Commercial PCB are produced by distilling chlorinated biphenyl mixtures. The name Aroclor is frequently used interchangeably with the term PCB, though not all PCBs are Aroclors.

PCBs are commonly found in transformers, power capacitors, hydraulic fluids, diffusion pump oil, and other heat transfer applications. Since 1971, the use of PCBs in the United States has been limited to the manufacture of transformers and high voltage capacitors. As of 1975, no substitute for the high dielectric and heat resistance properties and the non-flammable characteristics of PCBs was available (Ref. 11). In 1979, Congress banned the manufacture, processing, distribution, and use of PCBs except in completely enclosed systems such as electric transformers, capacitors, and electromagnets. Since this ban, various regulations have attempted to control further distribution of PCBs, including PCB that is incidentally generated along with some other desired product (Ref. 10).

The toxic effects of PCBs range from death in the lower invertebrates, to physiological disturbances in primates and humans (Ref. 11). PCBs in conjunction with other chemicals combine synergistically to increase risks of cancer at a much lower concentration than either chemical exhibits alone. PCB compounds are classified as human suspect carcinogenic, and are toxic substances regulated under the Toxic Substance Control Act (TSCA).

3.4 ENVIRONMENTAL FATE OF PCBs

PCBs are chlorinated aromatic organic compounds. They are very stable and cannot be decomposed by bacterial, enzymic, or any other biological or environmental activity. The PCB half-life is not known. Solubility in water is very low and depends on the amount of chlorination. As the percentage of chlorination in the moleule increases, the solubility decreases. PCB are very soluble in fats, and thus, they tend to accumulate in adipose tissue. The listed water quality criteria for PCB in fresh water and marine ecosytems is 0.001 ppb (Ref. 12).

PCBs can be extracted from water solutions using hexane. It can be absorbed from solutions or vapors by activated charcoal or polymeric resins (Amberlite XAD-4 or XAD-7). A common method of destroying the PCB molecule is through the use of special industrial furnaces. The decomposition of this class of molecules occurs at 24000° F.

Table 3-2

Distribution of PCBs by Level of Chlorination

Isomer Group	Molecular Formula	No. of Compounds
Monochlorobiphenyls	$C_{12}H_9Cl$	3
Dichlorobiphenyls	$C_{12}H_8Cl_2$	12
Trichlorobiphenyls	$C_{12}H_7Cl_3$	24
Tetrachlorobiphenyls	$C_{12}H_6Cl_4$	42
Pentachlorobiphenyls	$C_{12}H_5Cl_5$	46
Hexachlorobiphenyls	$C_{12}H_4Cl_6$	42
Heptachlorobiphenyls	$C_{12}H_3Cl_7$	24
Octachlorobiphenyls	$C_{12}H_2Cl_8$	12
Nonachlorobiphenyls	$C_{12}HHCl_9$	3
Decachlorobiphenyl	$C_{12}Cl_{10}$	1
TOTAL NUMBER OF CONGENERS		209

Ref. 10

SECTION 4: PHYSICAL SETTING

4.1 TOPOGRAPHY AND DRAINAGE

The site topography is essentially flat with a very gentle slope (0 to 3 percent) to the east. Locally the slope has been modified around buildings and other facilities.

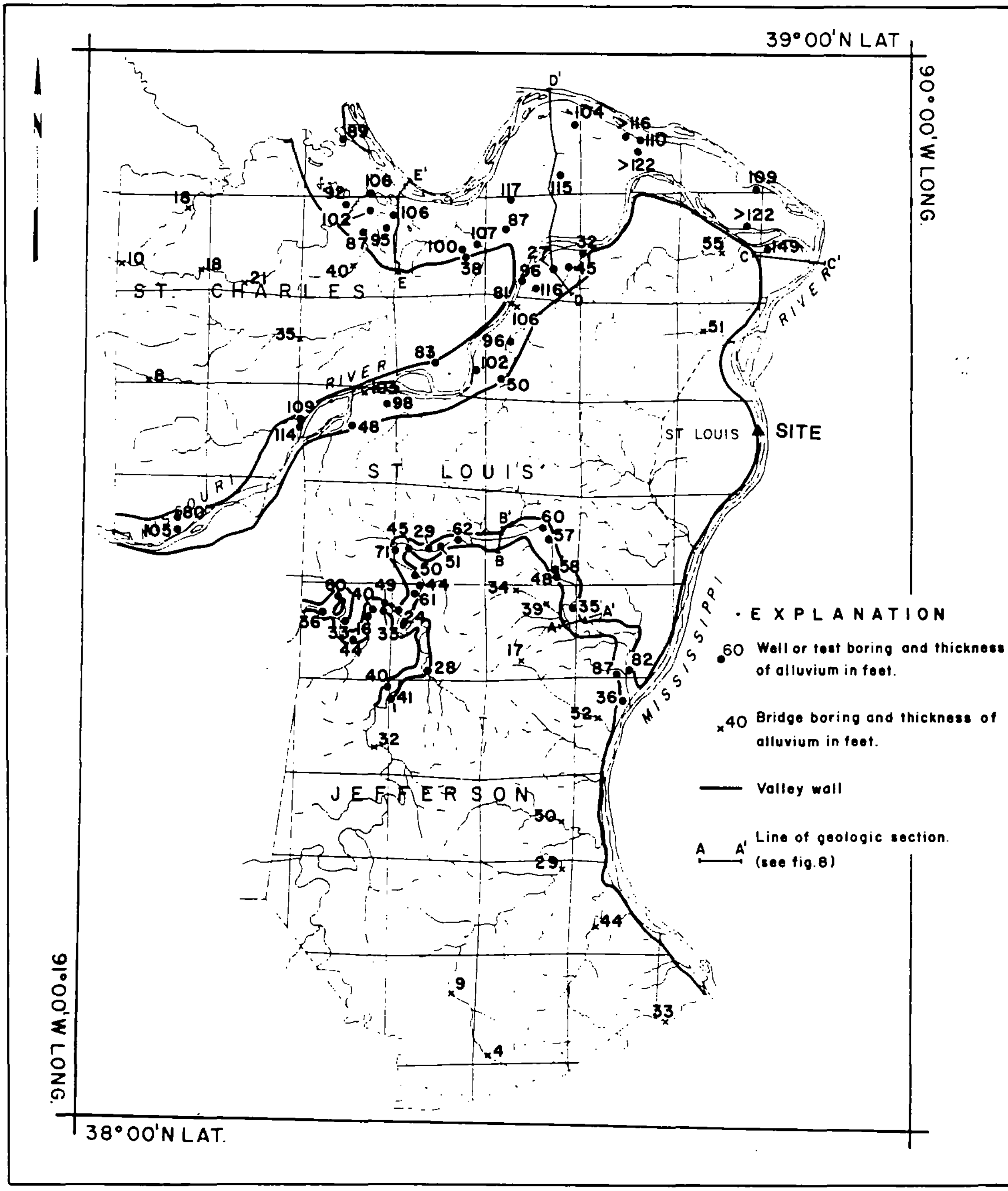
Surface drainage flows to the east directly into the Mississippi River. The site is protected from flooding by the U.S. Corps of Engineer concrete levee wall (Ref. 3).

4.2 SOILS AND STRATIGRAPHY

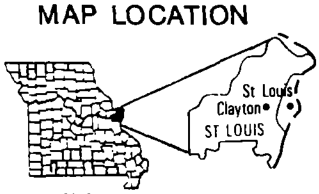
The soils in the area belong to the Harvester, Fishpot and Urban Land associations. These soils are classified as fine loams to fine silty clay loams. On site, the soils belong to the Urban Land, bottom land unit. This unit consists of areas in which more than 85 percent of the surface is covered by asphalt, concrete, buildings, or other impervious material.

The area was originally bottom land which was built-up to protect the site from flooding. The amount of fill in the area can range from 0 to over 200 feet. Variability of the soils in the area makes identification impractical without a detailed on-site investigation (Ref. 13). Figure 4-1 depicts the thickness of the alluvium along the Missouri, Mississippi, and Meramac rivers in St. Louis County.

The bedrock stratigraphy beneath the site belongs to the upper Mississippian and lower Pennsylvanian systems, which are roughly 286 to 360 million years old. Figure 4-2 shows that these systems are subdivided, in descending order, into the Pleasanton, Marmaton and Cherokee groups of the Pennsylvanian System, and the Mermacian series of the Mississippian System (Ref. 14).



MAP LOCATION



SCALE

0 5 10
MILES

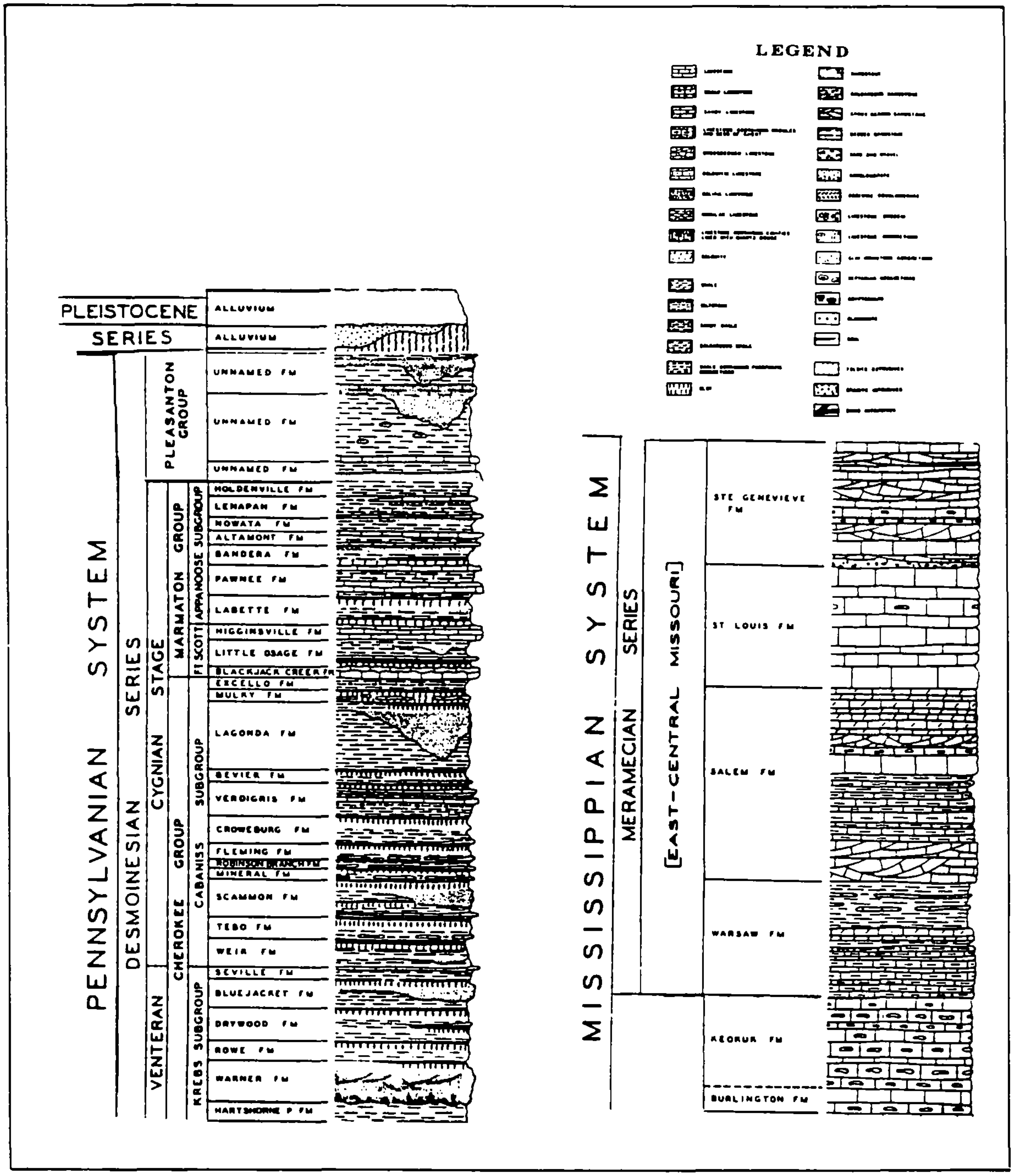
MOUND STREET POWER STATION

ST. LOUIS, MISSOURI

WASTE SITE TRACKING NO.: MO0579
PREPARED BY: JOHN C. PARKS

ECOLOGY AND ENVIRONMENT FIT DEC. 1987
SOURCE: WATER RESOURCES ST. LOUIS AREA MISSOURI

FIGURE 4-1 : ALLUVIUM THICKNESS ALONG THE MISSOURI, MISSISSIPPI AND MERAMEC RIVERS ST. LOUIS COUNTY MISSOURI



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SOURCE: STATIGRAPHIC SUCCESSION IN MISSOURI

FIGURE 4-2: GENERALIZED STRATIGRAPHIC SECTION ST.LOUIS COUNTY, MISSOURI

The Mermacian Series contains the following formations: Warsaw, Salem, St. Louis, and Ste. Genevieve. The predominant rock type is a finely crystalline, sometimes fossiliferous limestone with some dolomite. This series displays a typical cyclothemic succession (transgressive/regressive limestones with interbedded shales) though not necessarily a complete one. Chert is a very common accessory in the upper portions of the series (Ref. 14).

The overlying Pennsylvanian deposits are predominantly clastic in origin. However, numerous limestone, coal and shale beds occur. The lower groups (Cherokee and Marmation) have formal subdivisions while the Pleasanton consists of undifferentiated shales, siltstones, sandstones, coal, and, to a lesser degree, limestone (Ref. 14).

The specific stratigraphy beneath the site can be inferred from regional data. However, for more accurate information a more in depth, site specific geologic study would be useful.

4.3 HYDROGEOLOGY/WATER RESOURCES

The water needs of the city and surrounding community are met primarily through the withdrawal of surface water from the Missouri, Mississippi, and Meramac rivers. The municipal water intakes for the city of St. Louis and surrounding communities are approximately 9 miles upstream from the site (Ref. 1). The combined flow from the Missouri and Mississippi rivers averages approximately 1.12×10^{10} gallons per day. The Meramac has an average flow of 1.93×10^{9} gallons per day. Withdraw from these rivers totals nearly 1.12×10^{9} gallons per day (Ref. 7). Because there is an abundance of potable surface water, ground water is not utilized as a source of drinking water. The bedrock aquifers for the region are divided into five discrete units appropriately labeled one through five. Figure 4-3 shows the section view of the aquifers and Figure 4-4 shows the distribution. Group one, the Post-Maquoketa group, includes the strata above the Kimmswick Formation to the surface. Below this aquifer group lies the Maquoketa shale. Based on current information, the shale acts as an aquitard.

Aquifers most favorable as water sources are shaded

System	Series	Group	Formation	Aquifer group	Thickness (feet)	Dominant lithology	Water-bearing character
Quaternary	Holocene		Alluvium 1/		0-150	Sand, gravel, silt, and clay.	Some wells yield more than 2,000 gpm.
	Pleistocene		Loess		0-110	Silt	Essentially not water yielding
			Glacial till		0-55	Pebbly clay and silt.	
Pennsylvanian	Missourian	Pleasanton	Undifferentiated		0-75	Shales, siltstones, "dirty" sandstones, coal beds and thin limestone beds.	Generally yields very small quantities of water to wells. Yields range from 0-10 gpm.
		Marmaton	Undifferentiated		0-90		
	Desmoinesian	Cherokee	Undifferentiated		0-200		
	Atokan		Undifferentiated				
Mississippian	Meramecian		Ste. Genevieve Formation	1	0-160	Argillaceous to arenaceous limestone.	Yields small to moderate quantities of water to wells. Yields range from 5 to 50 gpm. Higher yields are reported for this interval locally.
			St. Louis Limestone		0-180		
			Salem Formation		0-180		
			Warsaw Formation		0-110		
	Osagean		Burlington-Keokuk Limestone		0-240	Cherty limestone	
			Fern Glen Formation		0-105	Red limestone and shale.	
	Kinderhookian	Chouteau	Undifferentiated		0-122	Limestone, dolomitic limestone, shale, and siltstone.	
Devonian	Upper	Sulphur Springs	Bushberg Sandstone		0-60	Limestone and sandstone.	
			Glen Park Limestone				
			Grassy Creek Shale		0-50	Fissile, carbonaceous shale.	
Silurian			Undifferentiated		0-200	Cherty limestone.	
Ordovician	Cincinnatian		Maquoketa Shale		0-163	Silty, calcareous or dolomitic shale.	Probably constitutes a confining influence on water movement.
			Cape Limestone		0-5	Argillaceous limestone.	
	Champlainian		Kimmswick Formation	2	0-145	Massive limestone	Yields small to moderate quantities of water to wells. Yields range from 3 to 50 gpm. Decorah Formation probably acts as a confining bed locally.
			Decorah Formation		0-50	Shale with interbedded limestone.	
			Plattin Formation		0-240	Finely crystalline limestone.	
			Rock Levee Formation		0-93	Dolomite and limestone, some shale.	
			Joachim Dolomite		0-135	Primarily argillaceous dolomite.	
			St. Peter Sandstone	3	0-160	Silty sandstone, cherty limestone grading upward into quartzose sandstone.	Yields moderate quantities of water to wells. Yields range from 10-140 gpm.
			Everton Formation		0-130		
	Canadian		Powell Dolomite	4	0-150	Sandy and cherty dolomites and sandstone.	Yields small to large quantities of water to wells. Yields range from 10 to 300 gpm. Upper part of aquifer group yields only small amounts of water to wells.
			Cotter Dolomite		0-320		
			Jefferson City Dolomite		0-225		
			Roubidoux Formation		0-177		
			Gasconade Dolomite Gunter Sandstone Member		0-280		
Cambrian	Upper		Eminence Dolomite	5	0-172	Cherty dolomites, siltstones, sandstone, and shale.	Yields moderate to large quantities of water to wells. Yields range from 10 to 400 gpm.
			Potosi Dolomite		0-325		
		Elvins	Derby-Doerun Dolomite		0-165		
			Davis Formation		0-150		
			Bonneterre Formation		245-385		
			Lamotte Sandstone		235+		
Precambrian						Igneous and metamorphic rocks.	Does not yield water to wells in this area.

1/ Basal part may be of Pleistocene age.

NOTE: Stratigraphic nomenclature may not necessarily be that of the U.S. Geological Survey.

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FIGURE 4-3: GENERALIZED HYDROGEOLOGIC SECTION ST. LOUIS COUNTY MISSOURI

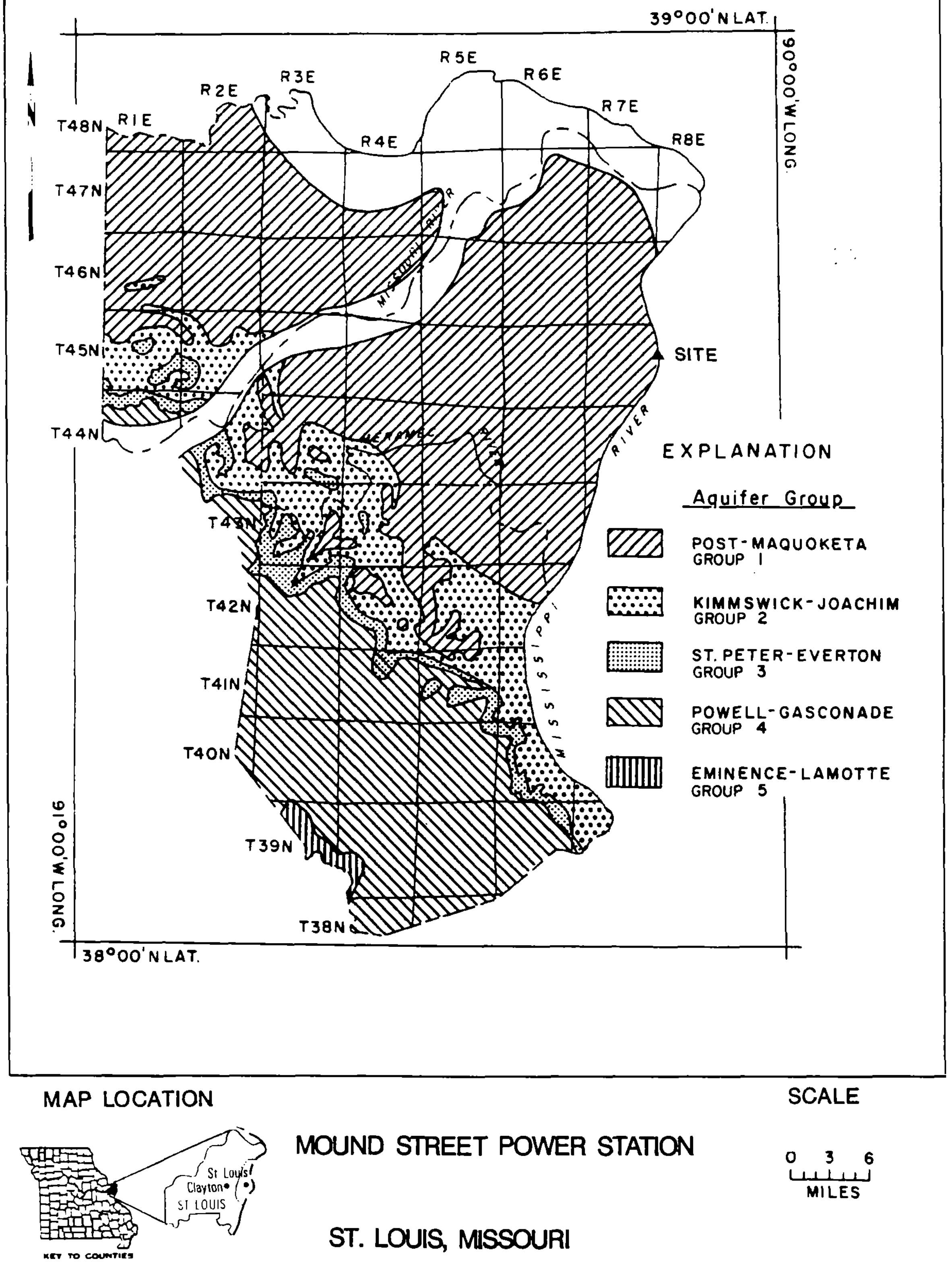

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FIGURE 4-4: MAJOR AQUIFER DISTRIBUTION ST. LOUIS COUNTY MISSOURI

Group two is the Ordovician age Kimmswick-Joachim aquifer. Near the top of this unit is the Decorah Formation, which probably acts as a confining bed composed of shales and interbedded limestones. The remaining lower three aquifers are separated primarily on the basis of unconformities. It is likely these aquifer groups, in descending order, the St. Peter-Everton, Powell-Gasconade and the Eminence-Lamotte are hydraulically connected.

Generally the bedrock aquifers of the region yield very small quantities of water; roughly 0 to 50 gallons per minute (gpm). The alluvial aquifers (Post-Maquoketa) completed along the Meramac, Mississippi, and Missouri rivers can provide much larger quantities. For example, the Weldon Springs Ordinance Plant production well yields almost 2,000 gpm. Other large yield industrial wells may be located near the rivers so that water would be drawn from these surface sources.

Figure 4-5 provides the specific capacities reported for wells completed in the river alluvium. Specific capacity is the rate of discharge from a well expressed as gallons per minute per feet of drawdown. Generally, the higher the specific capacity the higher the transmistivity and therefore the greater the susceptibility to contaminant migration.

City or subdivision	Owner	Well location	Depth (feet)	Well diameter (inches)	Date of test	Pumping rate (gpm)	Duration of test (hours)	Specific capacity (gpm/ft drawdown)	Draw-down (feet)	Remarks
				Bedrock aquifers						
City of De Soto		39-6-3add	[illegible]00	10	Aug. 195[illegible]	465	-	[illegible]	[illegible]	Potosi Dolomite (Group 5)
-	Burt Manor Nursing Home	39-5-20dda	513	6	-	26	6	0.73	36	Lower part of Gasconade Dolomite Eminence Dolomite (Groups 4 & 5)
	Robert Schroeder	39-5-31dba	285	6	Jan. 1960	18	1	0.09	200	Jefferson City-Roubidoux (Group 4)
-	Blanche Combs Trailer Court	40-3-32	1050	6	1967	60	6	1.33	45	Bonneterre-Lamotte (Group 5)
	Jefferson County Memorial Hospital	40-6-17bdc	750	6	1955	48	24	0.44	176	Cotter-Lower part of Gasconade (Group 4)
-	Mississippi River Fuel Corp. River Cement	40-6-27ade	1000	8	-	82	8	0.44	187	St. Peter-Upper part of Gasconade (Groups 3 & 4)
-	Dow Chemical Co.	41-6-18dac	393	-	1956	140	12	0.98	143	St. Peter-Everton (Group 3)
City of Cedar Hill	-	42-3-25abb	902	8	May 1953	50		0.24	212	Cotter-Eminence (Groups 4 & 5)
-	Jefferson County Water District No. 9	42-5-31bcc	1200	8	1967	130	24	1.43	90	Powell-Roubidoux (Group 4)
-	Beaumont Boy Scout Reservation	43-4-2bca	540	6	1950	50	24	0.44	113	Plattin-St. Peter (Groups 2 & 3)
Briar-Cliff Estates	Leonard Small Realty Co.	43-4-12bdc	675	6	Sept. 1959	23	24	0.21	107	Kimmswick-Everton (Groups 2 & 3)
-	Babler State Park	45-3-28bbd	1072	10	Aug. 1940	182	26	1.61	113	Joachim-St. Peter (Groups 2 & 3)
-	C. Kalmon	46-7-20	655	6	Feb. 1936	120	4	0.89	135	Ste. Genevieve-Burlington (Group 1)
-	Atlas Powder Co.	46-3-28ddd	811	8	Feb. 1941	13	3	0.07	200	Kimmswick-St. Peter (Groups 2 & 3)
Lake St. Louis	-	47-2-27	1375	8	Mar 1970	140	4	0.76	193	Plattin-Roubidoux (Groups 2, 3, & 4)
City of O'Fallon	Well No. 3	47-3-20ada	1500	8	Oct. 1960	132	2	2.64	50	Kimmswick-Upper part of Gasconade (Groups 2, 3, & 4)
-	Monsanto Chemical Co.	47-3-23ccc	1397	10	April 1967	183	24	0.53	348	Kimmswick-Roubidoux (Groups 2, 3, & 4)
City of O'Fallon	Well No. 1	47-3-29aaa	833	8	Sept. 1960	55	24	0.25	221	Kimmswick-St. Peter (Groups 2 & 3)
				Mississippi River alluvium						
Portage des Sioux	Portage des Sioux	48-6-15bcb	116	8		500	4	48	10.5	10 screen
-	Blue Wing	47-6-7cbd	100	16		2000				
-	Whistling Wing	47-4-11dba	80			1230		85	14.6	
-	Lindberg & Kenney	48-3-35cbd	136	16		2249		80	28	
-	Ore Farm	47-3-4ade	92			1690		105	16	
-	Hermitage Club	47-3-12ada	106	16		1750		175	10	
-	Webfoot Club	47-3-12cdd	95	14		1900		83	23	32-ft screen
St Charles	St. Charles	47-4-26	107							T=36,180 cubic feet per day per foot S=.0004
-	Portage Farms	48-5-23dad	107	26	Sept. 1963	1160		102	11.4	
				Missouri River alluvium						
-	Mr. Ambo	46-4-25bbd	102	16	1963	940	2	168	5	32-ft screen. Well not pumped at steady rate.
-	Mr. Smittle	46-5-17	96	12		500				32-ft screen
-	Mr. Twillman	46-4-28	93	12		400		69	13	
	Weldon Springs Ordnance Plant	45-3-18bcc	107	15	1967	1550	47			Aquifer test. T=36,180 cubic feet per day per foot S=0.2
				Meramec River alluvium						
Valley Park	Valley Park	44-5-18dda1	61	18	Aug. 1949	504	24	72	7	15 ft of 18-inch screen
Valley Park	Valley Park	44-5-18dda2	63	18	July 1949	504	24	36	14	15 ft of 18-inch screen. Yield has increased to 47 gpm/ft after treatment for capacity loss.
Valley Park	Absorbent cotton	44-5-17cdb	63	16	May 1957	500	12	93	6	15 ft of 16-inch screen gravel pack.
Valley Park	Ashland Chemical	44-5-17cbd	59	16	Oct. 1959 June 1964	503 554	- -	102 111	5 5	15 ft of 16-inch screen gravel pack.
Kirkwood	Kirkwood No. 1 Kirkwood No. 2	44-5-15 44-5-15	37 42	18 18	Dec. 1926 Nov. 1927	300 250	10 13	60 83	5 3	18 ft of 18-inch screen 20 ft of 18-inch concrete screen.

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SOURCE: WATER RESOURCES ST. LOUIS AREA MISSOURI

FIGURE 4-5: WELL SUMMARY FOR ST. LOUIS AREA

SECTION 5: POTENTIAL MIGRATION AND RECEPTORS

5.1 GROUND WATER ROUTE

It is highly probably that coal gasification wastes, if they are present on-site, are being released into local ground water. Since this preliminary assessment revealed no ground water use, there are no potential targets. If uses could be documented, then a potential target population could be identified.

5.2 SURFACE WATER ROUTE

Although the site is separated from the river by a levee, it is possible that materials potentially released into the ground water are being discharged into the Mississippi River. All city of St. Louis surface water intakes are approximately 9 miles upstream of the site. The only potential target populations are recreational uses, possible commercial fishing, and industrial intakes.

The oils contained in the basement may be hydraulically connected to the river by abandoned pipelines. This is the suspected migration route for oil that was the source of the three spills noted by the U.S. Coast Guard. Any oil releases to surface water would put the same targets as risk, that are at listed above.

5.3 AIR ROUTE

None of the potential wastes associated with this site have a potential for air release unless the facility is involved in a major structural fire. Because no PCB contaminants were detected in the oil, a fire would not cause a release of dioxin. A major fire could cause an air release of PAH materials, if the fire reached potential contamination areas. If an air release occurred it would target the majority of the St. Louis and or East St. Louis populations, depending on prevailing wind direction.

5.4 ON-SITE PATHWAY

If coal gasification wastes are present at this site, there is a great potential for direct contact with wastes. The population at risk would primarily involve local workers. Presently the E & E/FIT has no estimate of the size of this population. Direct contact with these wastes or contaminated soils could pose dermal, inhalation, and ingestion hazards.

SECTION 6: CONCLUSIONS

Based on the St. Louis Health Division and the E & E/FIT sampling there is no PCB contamination of the oils present in the basement of the former electric power plant. This statement is qualified in that the PCB detection limits were 1 ppm for the E & E/FIT data, and unknown for the St. Louis data. Concentrations of PCB below the 1 ppm detection limit are possible in the E & E/FIT samples. However, no evidence was uncovered suggesting that the oil in the basement should contain PCB. The initial concerns were raised based on the existence of large electric transformers located on site. The evidence suggests that the oil in these transformers was moved off-site. The most likely point of origin of the oil is the Apex Oil Terminal located several yards up-hill from the former electric power plant. This material is contained in a concrete basement and could be easily removed and sent to an oil recycling facility.

A search of historical documents provided information identifying this site as the location of the former Laclede Coal Gasification Plant. This facility may constitute the largest coal gas facility in Region VII.

SECTION 7: REFERENCES

1. United States Geological Survey Topographic Map, Granite City, Illinois.-Missouri., 7.5 Minute Quadrangle, 1968 revised.

2. Property Records contained in the E & E/FIT project file: TDD #F-07-8708-29 Mound Street Power Plant.

3. Log Book, for PA of the Mound Street Power Plant Site, Eric Hess, E & E/FIT, September 15 thru 17, 1987.

4. Survey of Town Gas and By-Product Locations in the U.S. (1880-1950), United State Environment Protection Agency, EPA/600/57-85/004, May 1985.

5. Handbook on Manufactured Gas Plant Sites, Environmental Research and Technologies, Inc., Koppers Company, Inc., Volume I, September 1984.

6. Part 1 and 2 1/2 hours transcribed taped interview with Eugene Hingtgen, Assistant Superintendent of the Key City Gas Plant, from 1946-1956. Interviewees: Eric Hess, Ted Faile, and John H. Parks, E & E/FIT, March 23, 1987.

7. City of St. Louis - Department of Health and Hospitals, Division of Health, Project Files on Mound Street Power Plant.

8. Ambient Water Quality Criteria for Polynuclear Aromatic Hydrocarbons, United State Environment Protection Agency Document PB81-117806, October 1980.

9. Expanded Site Investigation of the Peoples Natural Gas Site, Dubuque, Iowa, Project F-07-8701-20/FIA0176XA, September 1987.

10. Alford-Stevens, Ann L. Analyzing PCB, Environmental Science and Technologies, 20:12:1194-1199, 1986.

11. Nemerow, Nelson, L. Industrial Water Pollution. Addison Wesley Publishing Co., Inc., Reading Massachusetts, 1971.

12. Quality Criteria for Water, United State Environment Protection Agency Washington D.C., Stock #055-001-01049-4, 1976.

13. Soil Survey of St. Louis County, Missouri, Soil Conservation Service, United State Department of Agriculture, 1979.

14. Missouri Geological Survey and Water Resources, Stratigraphic Succession in Missouri, Volume XL, 1961.

Appendix A

EPA Form 2070-12

Mound St. Power Plant

EPA

POTENTIAL HAZARDOUS WASTE SITE PRELIMINARY ASSESSMENT
PART 1 - SITE INFORMATION AND ASSESSMENT

I. IDENTIFICATION

01 STATE: MO | 02 SITE NUMBER:

II. SITE NAME AND LOCATION

01 SITE NAME *(Legal, common, or descriptive name of site)*: Mound Street Power Plant	02 STREET, ROUTE NO., OR SPECIFIC LOCATION IDENTIFIER: Number 2 Mound Street
03 CITY: St. Louis	04 STATE: Mo; 05 ZIP CODE: 63101; 06 COUNTY: St. Louis; 07 COUNTY CODE: ; 08 CONG DIST:
09 COORDINATES LATITUDE: 38° 38' 00"0N; LONGITUDE: 090° 11'00".0E	

10 DIRECTIONS TO SITE *(Starting from nearest public road)*

Take interstate 70 east from Kansas City to St. Louis. Exit onto interstate 55 north. Take the next exit, Memorial Dr., north. Travel on Memorial Dr. several blocks to Mound St. and turn right onto Mound St. The site is located at the end of Mound St.

III. RESPONSIBLE PARTIES

01 OWNER *(If known)*: Herman Gellman, Pres. Mound St. Corp	02 STREET *(Business, mailing, residential)*: 3620 North Hall St.
03 CITY: St. Louis	04 STATE: MO; 05 ZIP CODE: 63147; 06 TELEPHONE NUMBER: (314) 2316077
07 OPERATOR *(If known and different from owner)*: none	08 STREET *(Business, mailing, residential)*:
09 CITY:	10 STATE: ; 11 ZIP CODE: ; 12 TELEPHONE NUMBER: ( )

13 TYPE OF OWNERSHIP *(Check one)*

X A. PRIVATE ☐ B. FEDERAL: ______ *(Agency name)* ☐ C. STATE ☐ D. COUNTY ☐ E. MUNICIPAL

☐ F. OTHER: ______ *(Specify)* ☐ G. UNKNOWN

14 OWNER/OPERATOR NOTIFICATION ON FILE *(Check all that apply)*

☐ A. RCRA 3001 DATE RECEIVED: __/__/__ (MONTH DAY YEAR) ☐ B. UNCONTROLLED WASTE SITE *(CERCLA 103 c)* DATE RECEIVED: __/__/__ (MONTH DAY YEAR) ☒ C. NONE

IV. CHARACTERIZATION OF POTENTIAL HAZARD

01 ON SITE INSPECTION: X YES ☐ NO DATE: 9 17 87 (MONTH DAY YEAR)

BY *(Check all that apply)*: ☐ A. EPA X B. EPA CONTRACTOR ☐ C. STATE ☐ D. OTHER CONTRACTOR ☐ E. LOCAL HEALTH OFFICIAL ☐ F. OTHER: ______ *(Specify)*

CONTRACTOR NAME(S): Ecology & Environment, Inc.

02 SITE STATUS *(Check one)*: ☐ A. ACTIVE X B. INACTIVE ☐ C. UNKNOWN

03 YEARS OF OPERATION: approx. 1973 (BEGINNING YEAR) | 1983 (ENDING YEAR) ☐ UNKNOWN

04 DESCRIPTION OF SUBSTANCES POSSIBLY PRESENT, KNOWN, OR ALLEGED

The oil in the former power plant basement may contain PCB. The wastes associated with the former coal gasification plant contain PAH, cyanide, metals, toluene and xylene.

05 DESCRIPTION OF POTENTIAL HAZARD TO ENVIRONMENT AND/OR POPULATION

The potential PCB,tolulene, xylene, PAH contaminants are carcinogenic. The potential cyanides, and metals have acute and chronic toxicities at relatively low environmental concentrations. Contact, inhalation and ingestion hazards exist for all potential contaminants.

V. PRIORITY ASSESSMENT

01 PRIORITY FOR INSPECTION *(Check one. If high or medium is checked, complete Part 2 - Waste Information and Part 3 - Description of Hazardous Conditions and Incidents)*

☐ A. HIGH *(Inspection required promptly)* X B. MEDIUM *(Inspection required)* ☐ C. LOW *(Inspect on time available basis)* ☐ D. NONE *(No further action needed, complete current disposition form)*

VI. INFORMATION AVAILABLE FROM

01 CONTACT	02 OF *(Agency/Organization)*			03 TELEPHONE NUMBER
Pauletta France-Isetts	Region Superfund			(913) 236-2856
04 PERSON RESPONSIBLE FOR ASSESSMENT	**05 AGENCY**	**06 ORGANIZATION**	**07 TELEPHONE NUMBER**	**08 DATE**
Eric Hess	Contractor	Ecology&Envir.	(913) 432-9961	1 / 4 / 88 (MONTH DAY YEAR)

Mound St. Power Plant

EPA

POTENTIAL HAZARDOUS WASTE SITE PRELIMINARY ASSESSMENT
PART 2 - WASTE INFORMATION

I. IDENTIFICATION

01 STATE	02 SITE NUMBER
MO	

II. WASTE STATES, QUANTITIES, AND CHARACTERISTICS

01 PHYSICAL STATES (Check all that apply)

- ☐ A. SOLID
- ☒ B. POWDER, FINES
- ☒ C. SLUDGE
- ☒ D. OTHER oil (Specify)
- ☐ E. SLURRY
- ☒ F. LIQUID
- ☐ G. GAS

02 WASTE QUANTITY AT SITE (Measures of waste quantities must be independent)

TONS ______
CUBIC YARDS unknown
NO. OF DRUMS ______

03 WASTE CHARACTERISTICS (Check all that apply)

- ☒ A. TOXIC
- ☐ B. CORROSIVE
- ☐ C. RADIOACTIVE
- ☒ D. PERSISTENT
- ☒ E. SOLUBLE
- ☐ F. INFECTIOUS
- ☐ G. FLAMMABLE
- ☐ H. IGNITABLE
- ☐ I. HIGHLY VOLATILE
- ☐ J. EXPLOSIVE
- ☐ K. REACTIVE
- ☐ L. INCOMPATIBLE
- ☐ M. NOT APPLICABLE

III. WASTE TYPE

CATEGORY	SUBSTANCE NAME	01 GROSS AMOUNT	02 UNIT OF MEASURE	03 COMMENTS
SLU	SLUDGE	unknown		Coal Tar
OLW	OILY WASTE	unknown		Fuel Oil or transformer oil.
SOL	SOLVENTS			
PSD	PESTICIDES			
OCC	OTHER ORGANIC CHEMICALS	unknown		Coal tar xylene and tolene
IOC	INORGANIC CHEMICALS	unknown		cyanide salts
ACD	ACIDS			
BAS	BASES			
MES	HEAVY METALS	unknown		Coal tar Associated

IV. HAZARDOUS SUBSTANCES (See Appendix for most frequently cited CAS Numbers)

01 CATEGORY	02 SUBSTANCE NAME	03 CAS NUMBER	04 STORAGE/DISPOSAL METHOD	05 CONCENTRATION	06 MEASURE OF CONCENTRATION
SLU	Coal Tar	800745-2	unknown	unknown	
SLU	Benzo (A) pyrene	50328	unknown	unknown	
OCC	Xylene	1330207	unknown	unknown	
OCC	Tolulene	108883	unknown	unknown	
OLW	Fuel Oil	NA	Open Pools	unknown	
OLW	Transformer Oil (PCB)	1336363	Open Pools	undetected	1 ppm detect. limit.
MES	Lead	74439921			
MES	Arsenic	7440382			
IOC	Cyanide	57125			

V. FEEDSTOCKS (See Appendix for CAS Numbers) None

CATEGORY	01 FEEDSTOCK NAME	02 CAS NUMBER	CATEGORY	01 FEEDSTOCK NAME	02 CAS NUMBER
FDS			FDS		
FDS			FDS		
FDS			FDS		
FDS			FDS		

VI. SOURCES OF INFORMATION (Cite specific references, e.g., state files, sample analysis, reports)

E&E/FIT Files
EP&R Files
Missouri Department of Health and Hospitals

Mound St. Power Plant

EPA

POTENTIAL HAZARDOUS WASTE SITE PRELIMINARY ASSESSMENT
PART 3 - DESCRIPTION OF HAZARDOUS CONDITIONS AND INCIDENTS

I. IDENTIFICATION	
01 STATE	02 SITE NUMBER
MO	

II. HAZARDOUS CONDITIONS AND INCIDENTS

01 X A. GROUNDWATER CONTAMINATION — 02 ☐ OBSERVED (DATE: ______) — XX POTENTIAL — ☐ ALLEGED
03 POPULATION POTENTIALLY AFFECTED: unknown
04 NARRATIVE DESCRIPTION

Coal tar wastes are potentially buried in unlined pits or stored in leaking containers.

01 X B. SURFACE WATER CONTAMINATION — 02 ☐ OBSERVED (DATE: ______) — X POTENTIAL — ☐ ALLEGED
03 POPULATION POTENTIALLY AFFECTED: unknown
04 NARRATIVE DESCRIPTION

Oil from site may have been released into the Mississippi River. If ground water contamination exists, it may allow release of contaminants into the surface water through surface water recharge.

01 ☐ C. CONTAMINATION OF AIR — 02 ☐ OBSERVED (DATE: ______) — ☐ POTENTIAL — ☐ ALLEGED
03 POPULATION POTENTIALLY AFFECTED: ______
04 NARRATIVE DESCRIPTION

none observed or likely.

01 X D. FIRE/EXPLOSIVE CONDITIONS — 02 ☐ OBSERVED (DATE: 9-17-87) — X POTENTIAL — ☐ ALLEGED
03 POPULATION POTENTIALLY AFFECTED: unknown
04 NARRATIVE DESCRIPTION

The basement of the former power plant contains several thousand gallons of potentially flamable oil.

01 X E. DIRECT CONTACT — 02 ☐ OBSERVED (DATE: 9-17-87) — X POTENTIAL — ☐ ALLEGED
03 POPULATION POTENTIALLY AFFECTED: unknown
04 NARRATIVE DESCRIPTION

Soil contamination from coal gasification wastes is likely.
Soil contamination could allow direct contact with wastes.

01 X F. CONTAMINATION OF SOIL — 02 ☐ OBSERVED (DATE: ______) — X POTENTIAL — ☐ ALLEGED
03 AREA POTENTIALLY AFFECTED: unknown (Acres)
04 NARRATIVE DESCRIPTION

Soil contamintion from coal gasification wastes is likely

01 ☐ G. DRINKING WATER CONTAMINATION — 02 ☐ OBSERVED (DATE: ______) — ☐ POTENTIAL — ☐ ALLEGED
03 POPULATION POTENTIALLY AFFECTED: none
04 NARRATIVE DESCRIPTION

Drinking water for St. Louis is obtained from surface water intakes over three miles upstream.

01 X H. WORKER EXPOSURE/INJURY — 02 ☐ OBSERVED (DATE: ______) — XX POTENTIAL — ☐ ALLEGED
03 WORKERS POTENTIALLY AFFECTED: unknown
04 NARRATIVE DESCRIPTION

Workers in the former power plant and at the Apex Oil St. Louis terminal (located on the former coal gas site) are not isolated from potential soil contamination.

01 ☐ I. POPULATION EXPOSURE/INJURY — 02 ☐ OBSERVED (DATE: ______) — ☐ POTENTIAL — ☐ ALLEGED
03 POPULATION POTENTIALLY AFFECTED: ______
04 NARRATIVE DESCRIPTION

none observed

Mound St. Power Plant

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POTENTIAL HAZARDOUS WASTE SITE PRELIMINARY ASSESSMENT
PART 3 - DESCRIPTION OF HAZARDOUS CONDITIONS AND INCIDENTS

I. IDENTIFICATION
01 STATE: MO
02 SITE NUMBER:

II. HAZARDOUS CONDITIONS AND INCIDENTS (Continued)

01 ☐ J. DAMAGE TO FLORA — 02 ☐ OBSERVED (DATE:) ☐ POTENTIAL ☐ ALLEGED
04 NARRATIVE DESCRIPTION

none observed

01 ☐ K. DAMAGE TO FAUNA — 02 ☐ OBSERVED (DATE:) ☐ POTENTIAL ☐ ALLEGED
04 NARRATIVE DESCRIPTION (Include name(s) of species)

none observed

01 ☒ L. CONTAMINATION OF FOOD CHAIN — 02 ☐ OBSERVED (DATE:) ☒ POTENTIAL ☐ ALLEGED
04 NARRATIVE DESCRIPTION

If materials are entering surface water, benthic organisms could bioaccumulate contaminants.

01 ☒ M. UNSTABLE CONTAINMENT OF WASTES (Spills/runoff/standing liquids/leaking drums) — 02 ☐ OBSERVED (DATE: 9-17-87) and ☒ POTENTIAL ☐ ALLEGED
03 POPULATION POTENTIALLY AFFECTED: unknown
04 NARRATIVE DESCRIPTION

Oils stored in open pools in basement. (observed). Coal tar wastes, if present, may be stored in unlined pits. (Potential)

01 ☐ N. DAMAGE TO OFFSITE PROPERTY — 02 ☐ OBSERVED (DATE:) ☐ POTENTIAL ☐ ALLEGED
04 NARRATIVE DESCRIPTION

none observed

01 ☒ O. CONTAMINATION OF SEWERS, STORM DRAINS, WWTPs — 02 ☐ OBSERVED (DATE: 9-17-87) ☐ POTENTIAL ☐ ALLEGED
04 NARRATIVE DESCRIPTION

Sewers adjacent to site contain several feet of oil.

01 ☒ P. ILLEGAL/UNAUTHORIZED DUMPING — 02 ☐ OBSERVED (DATE:) ☒ POTENTIAL ☐ ALLEGED
04 NARRATIVE DESCRIPTION

Oil may be the result of unreported spills from the Apex facility.

05 DESCRIPTION OF ANY OTHER KNOWN, POTENTIAL, OR ALLEGED HAZARDS

None observed

III. TOTAL POPULATION POTENTIALLY AFFECTED: unknown

IV. COMMENTS

Currently the site is considered to involve only the oil in the former power plant. The former coal gas site should be included in consideration of this site

V. SOURCES OF INFORMATION (Cite specific references, e.g., state files, sample analysis, reports)

E&E/FIT files.
EP&R files
St. Louis Department of Health and Hospital files.